Behaviour of a building block for intrinsic evolution of analogue signal shaping and filtering circuits

Stuart J Flockton and Kevin Sheehan

Royal Holloway, University of London

Egham Hill, Egham, Surrey

TW20 0EX, UK

S.Flockton@rhbnc.ac.uk, Kevin.Sheehan@rhbnc.ac.uk

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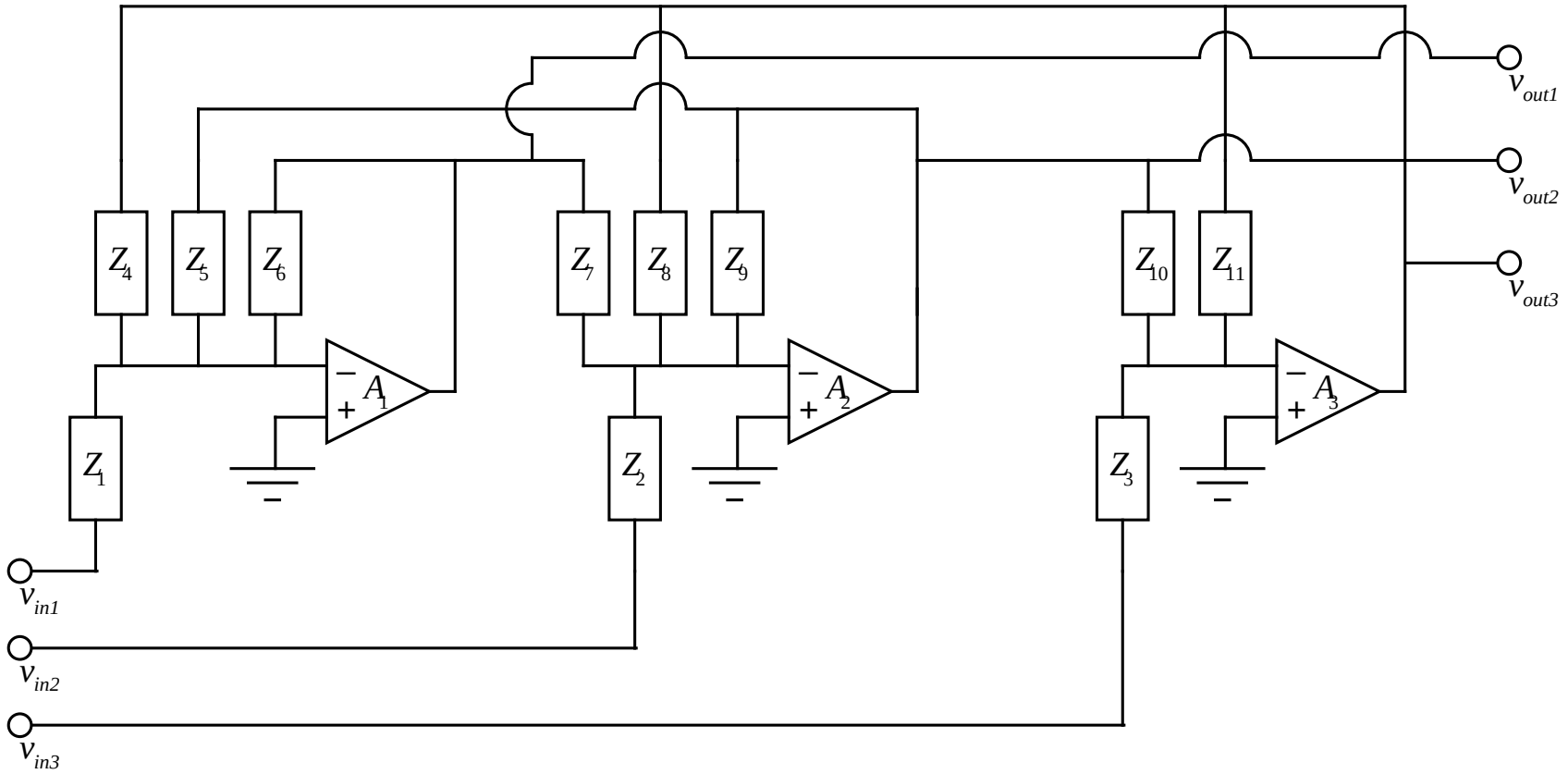
Introduction

- **Background to the generalised circuit**
- **Results from experiments on evolving linear filters in hardware**
- **Extension to nonlinear systems**
- **Summary and conclusions**

The generalised circuit

- **Background**
- **Changes from the previous circuit**
- **Producing nonlinear DC characteristics**
- **Producing circuits with memory, e.g. filters**



The generalised building block circuit

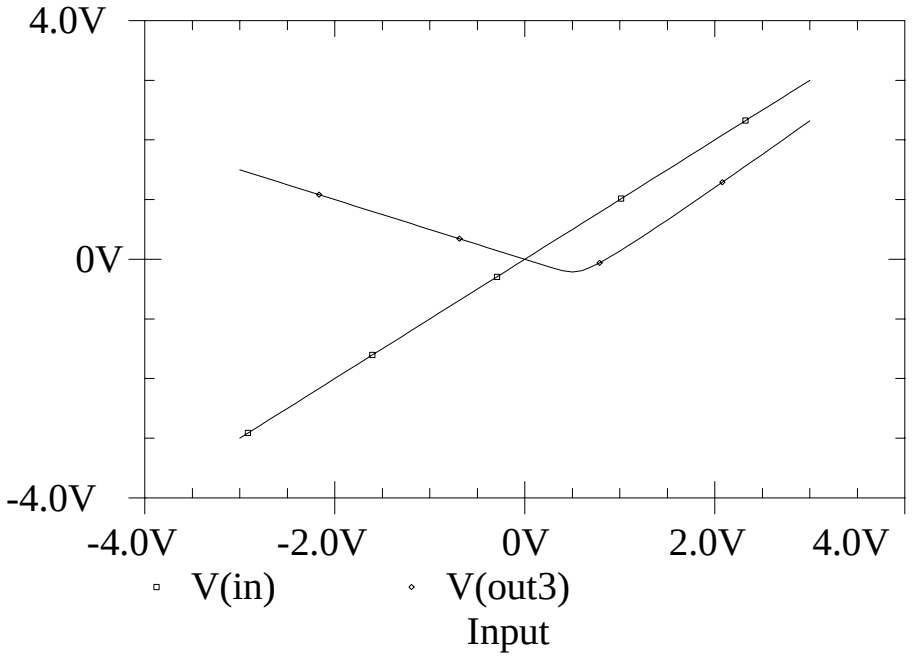


Figure 1: DC characteristic of the circuit detailed in Table 1, using resistors and one diode: input applied in parallel to v_{in2} and v_{in3}, output taken from v_{out3}.

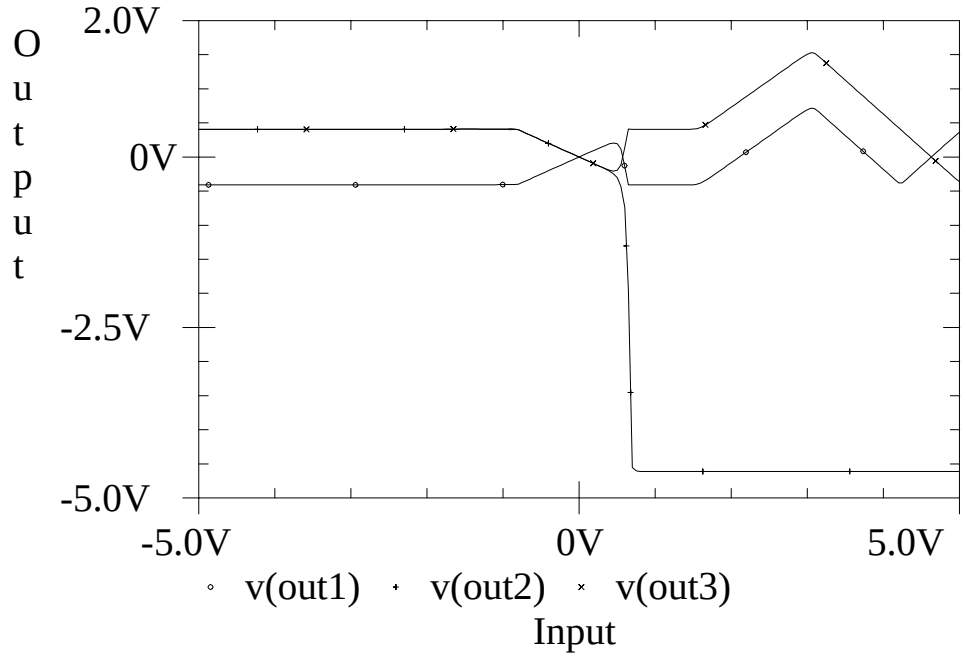


Figure 2: DC transfer characteristics corresponding to each of the three outputs of the circuit detailed in Table 2, using resistors and three diodes, with the input applied in parallel to v_{in2} and v_{in3}.

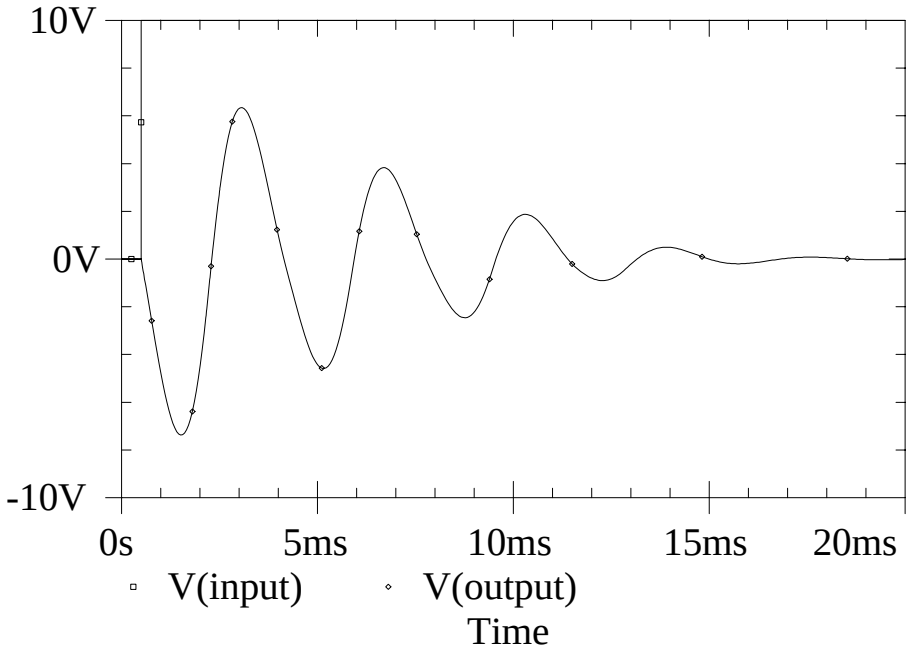
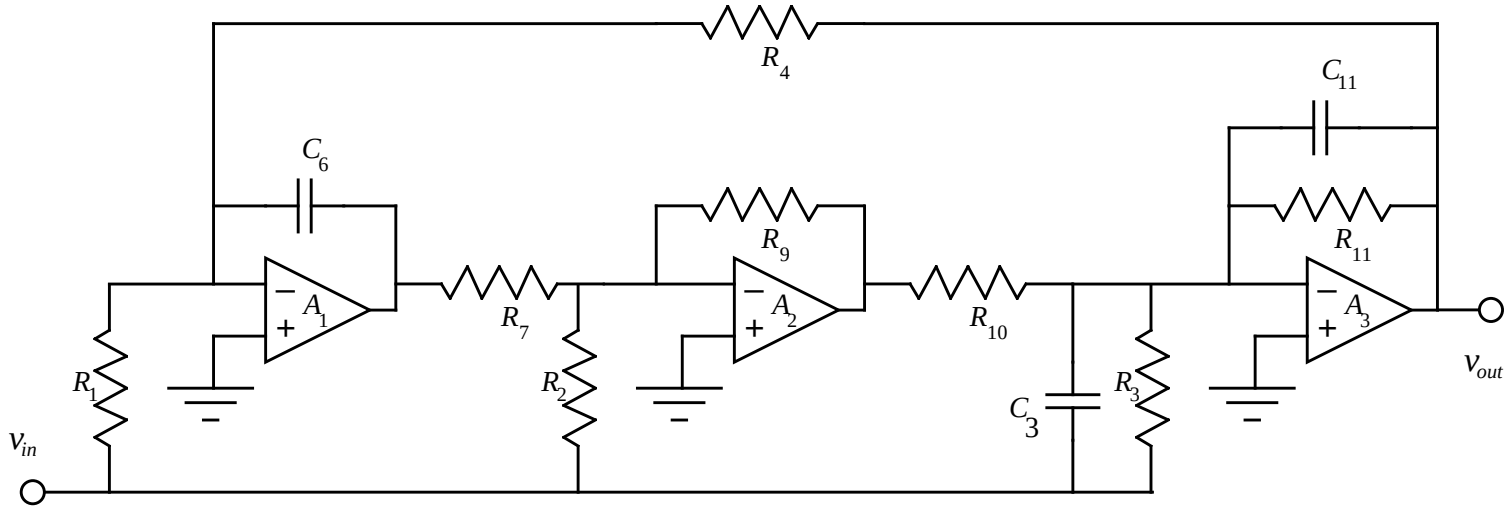


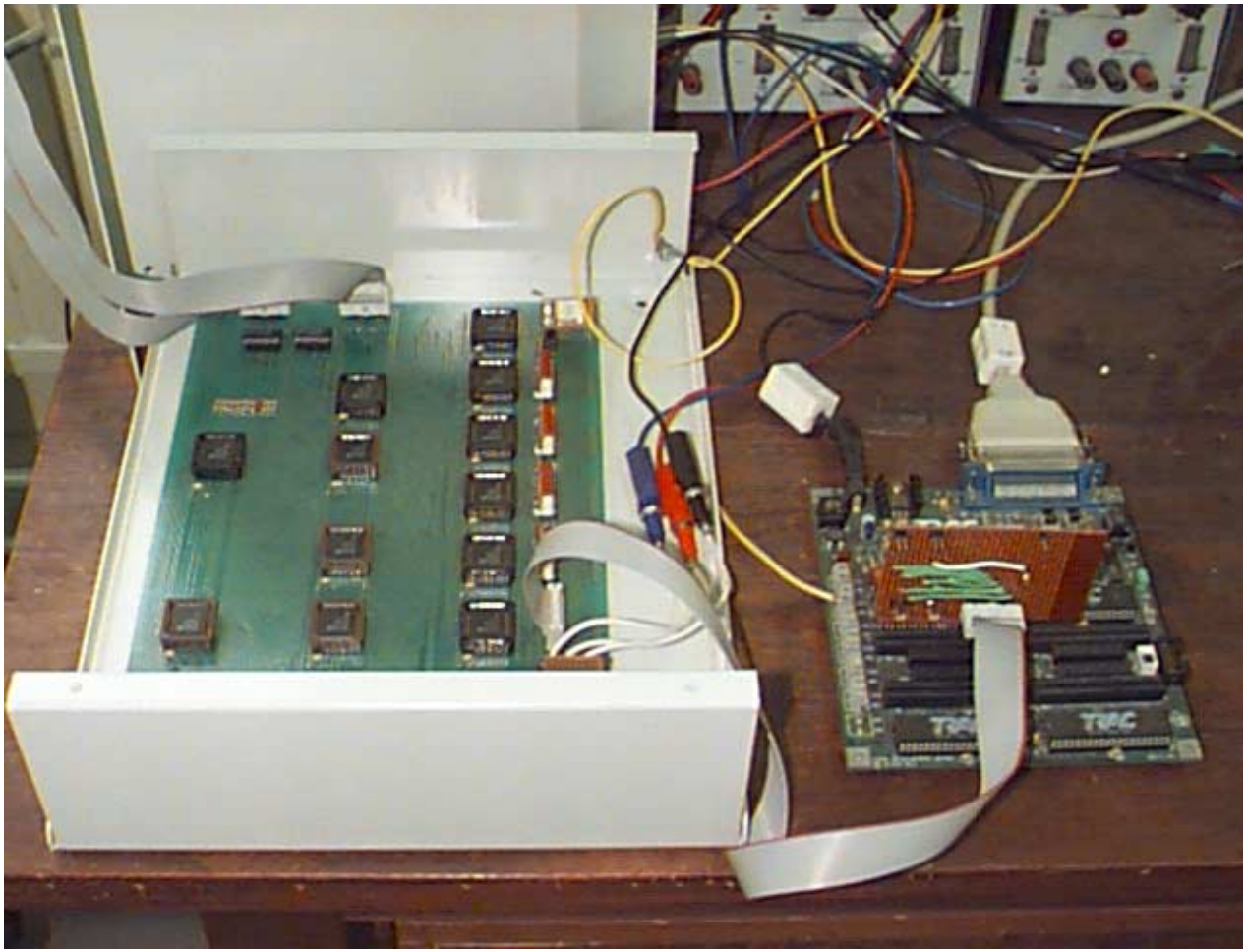
Figure 3: Step response of a single diode circuit (input to v_{in3}, output from v_{out3})whose values are given in Table 3.

Linear filters

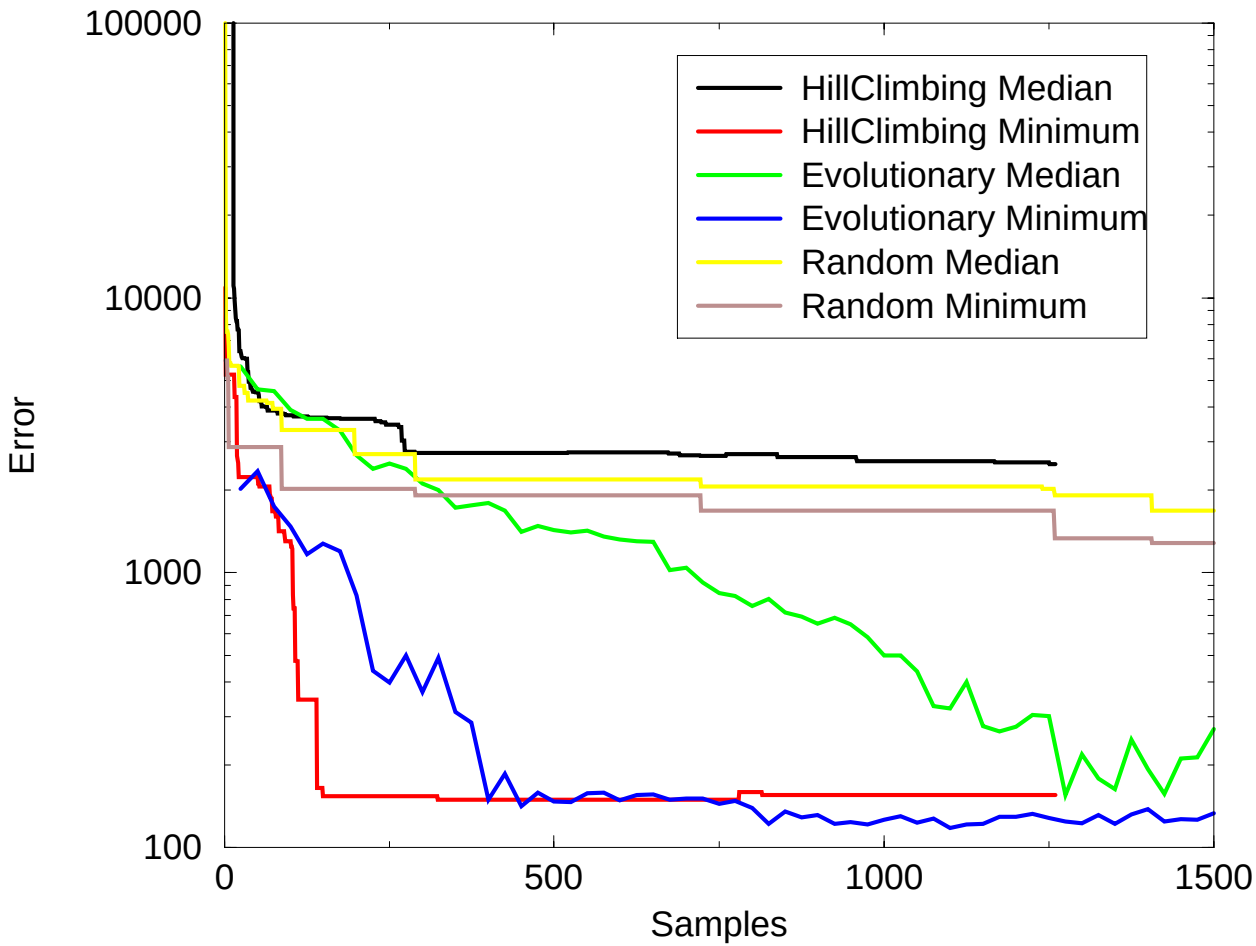
- **The circuit**
- **Hardware implementation of an evolvable filter, using a TRAC chip and an evolvable motherboard**
- **Quantifying the fitness**
- **Search algorithms**



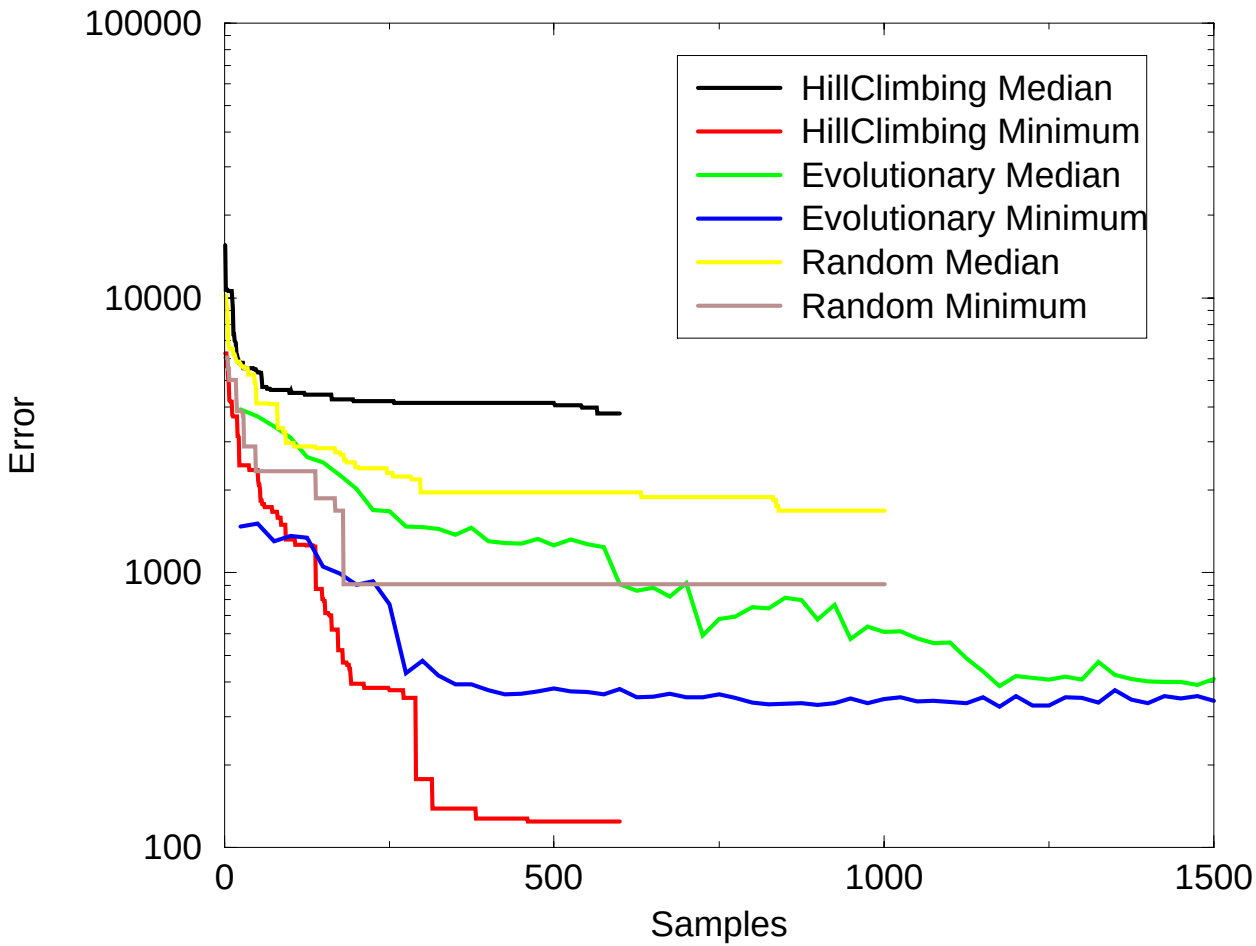
Configuration of the general block using resistors and capacitors only, implementing a biquadratic filter



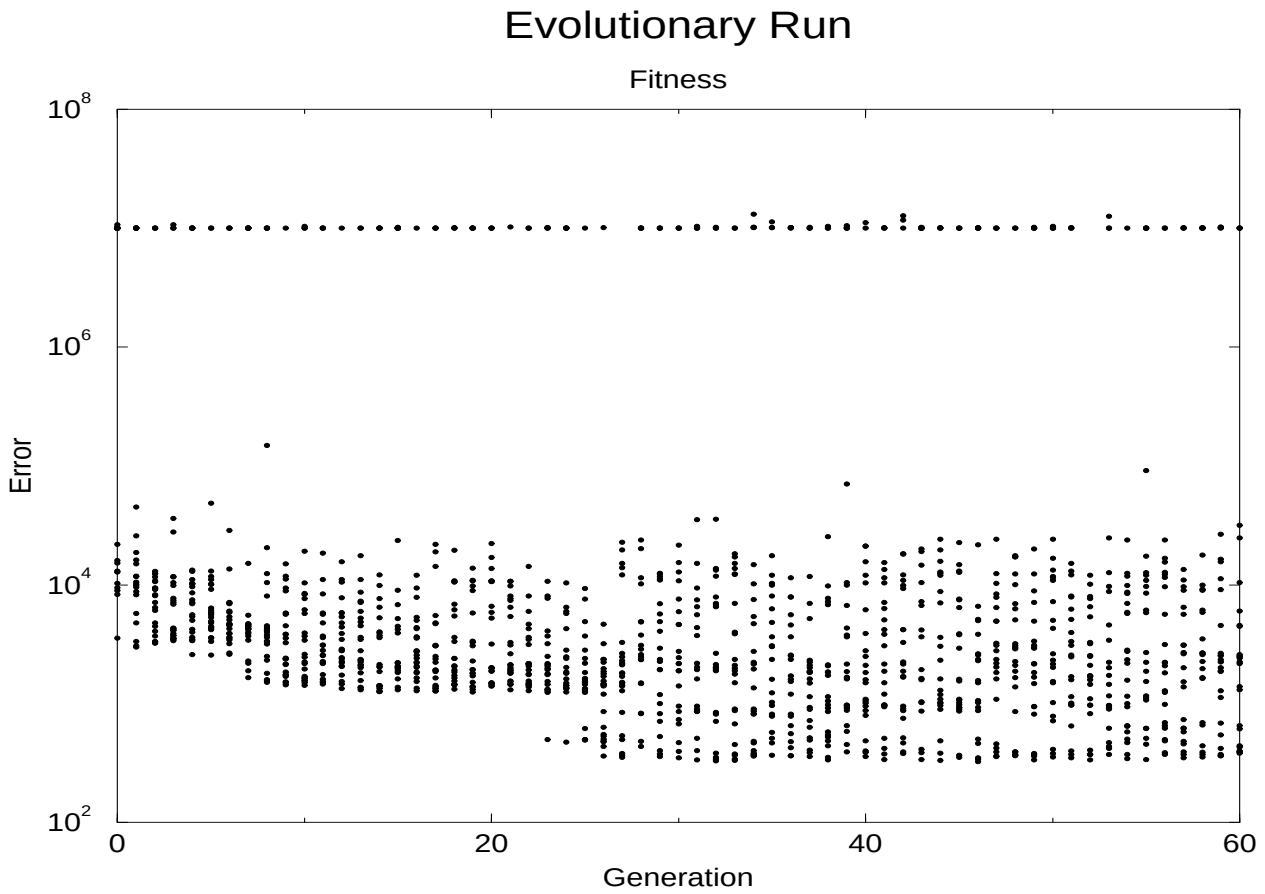
TRAC board attached to the evolvable motherboard



Comparison of algorithms for target 2



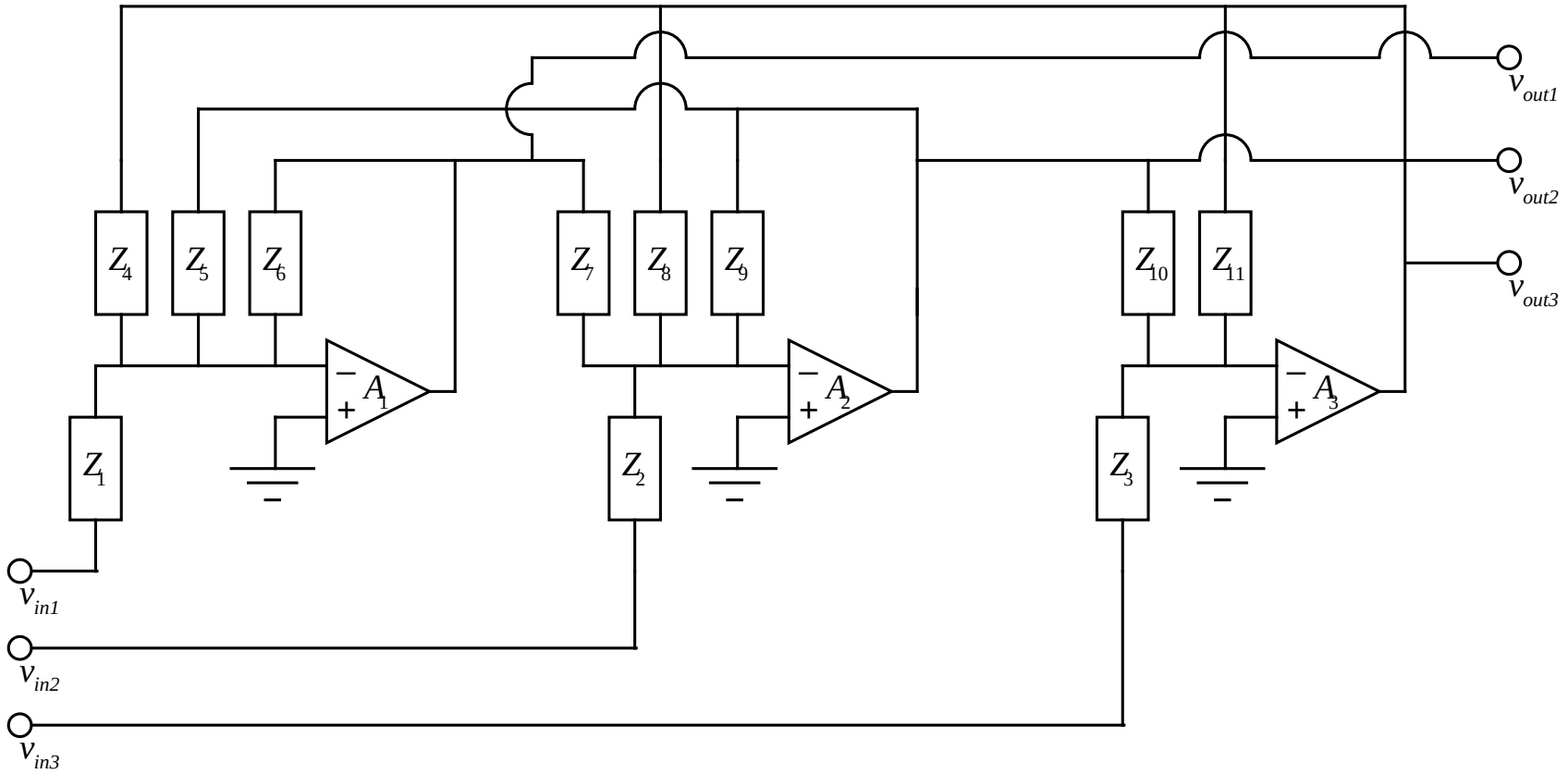
Comparison of algorithms for target 1



Graph showing the distribution of fitness during a run of the evolutionary algorithm.

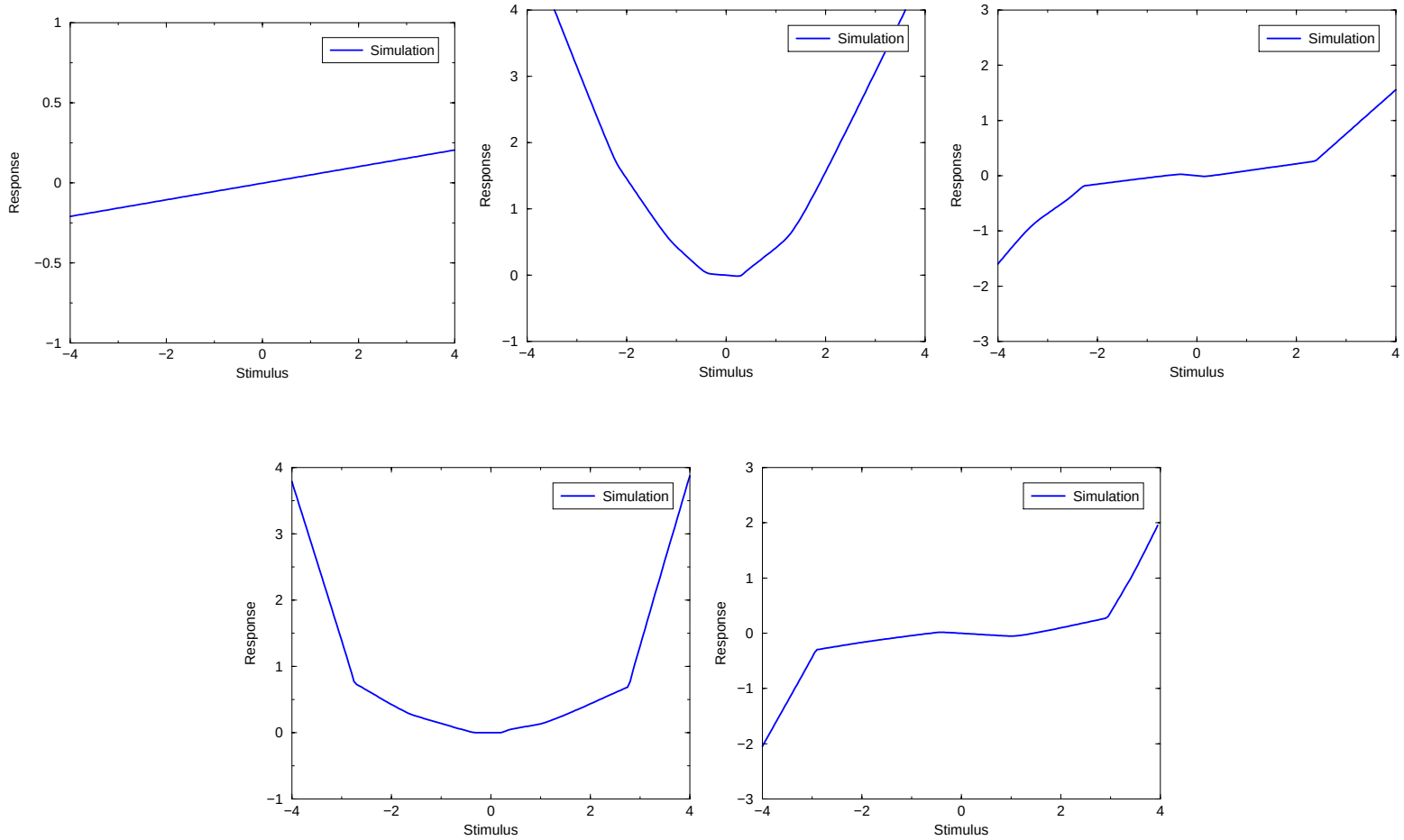
Generating arbitrary nonlinear DC characteristics

- **Description of the hardware**
- **Hardware implementation of an evolvable filter, using a TRAC chip and an evolvable motherboard**
- **Examples of various characteristics**

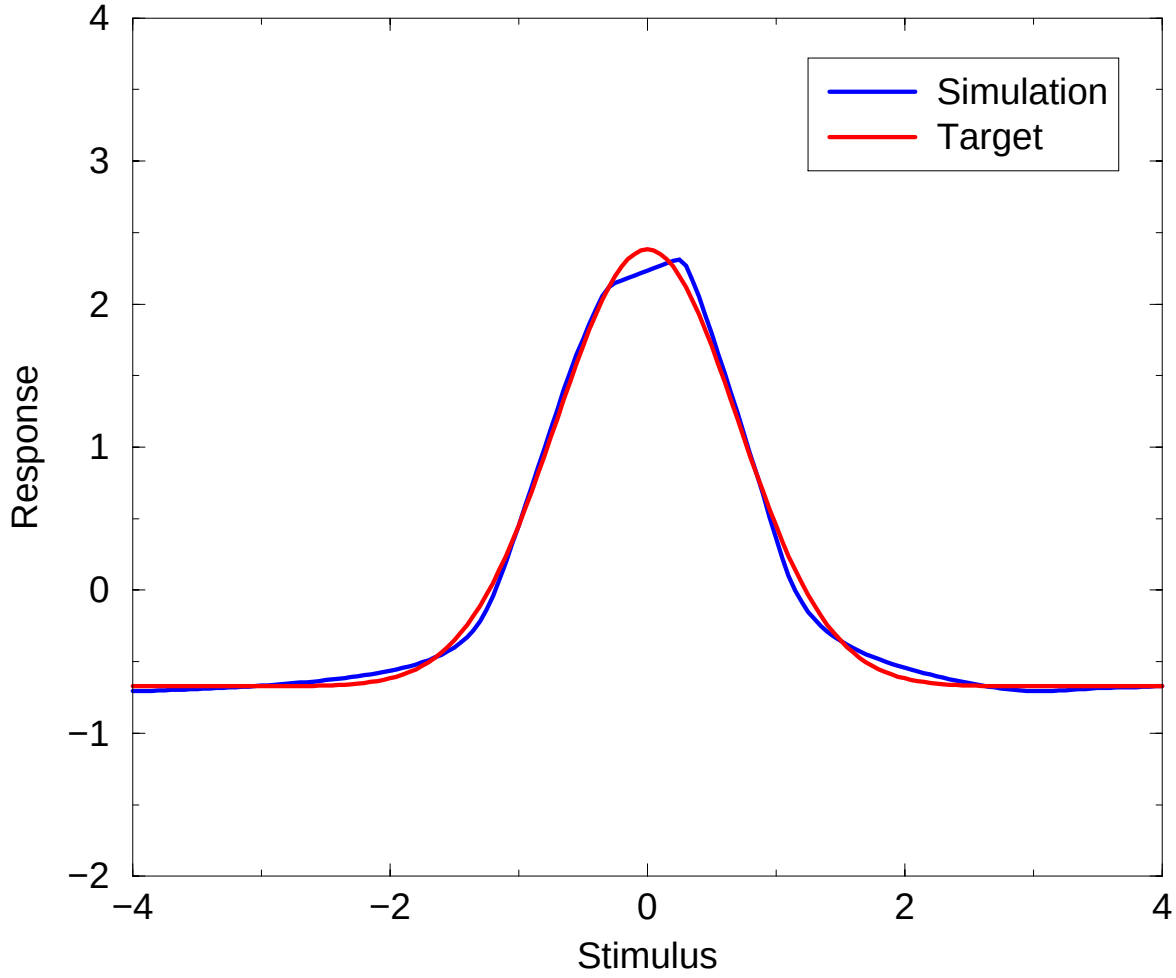


The generalised building block circuit

Card cage containing the evolvable motherboards and their power supply



Examples of approximations to polynomial responses



Simulated example of a gaussian block

Conclusions

Already done

- Building block proposed.
- Linear filters evolved in hardware.
- The ability to generate more complex responses demonstrated in simulation.
- Hardware to perform similar experiments constructed.

Still to do

- Investigate evolution of these more complex responses using the new hardware.